

Title: Interpreting Graphs

Brief Overview:

This lesson provides students with opportunities to explore graphic representations through kinesthetic modeling, written representation, and analysis. Students will use a graphing calculator and a Calculator–Based Ranger™ to collect, graph, and interpret data.

NCTM Content Standard:

Data Analysis and Probability

- Represent, analyze, and generalize a variety of patterns with tables, graphs, words, and, when possible, symbolic rules;
- Relate and compare different forms of representation for a relationship;
- Identify functions as linear or nonlinear and contrast their properties from tables, graphs, or equations.

Grade/Level:

Grade 6 Pre–Algebra

Duration/Length:

Three 45 minute lessons

Student Outcomes:

Students will:

- interpret graphs in order to create a story that represents the information provided by the graph
- kinesthetically model the relationship between two variables
- create a graphic representation of a written description
- represent and interpret a quantitative relationship in a graph

Materials and Resources:

- Graphing calculator
- Calculator–Based Ranger™
- Resource: Directions for Texas Instruments CBR
- Worksheets:
 - *Transparency $y = x$*
 - *Match that Graph!*
 - *Transparency Lesson 3*
 - *A Picture is Worth a Thousand Words*
 - *Story Sheet*
 - *Graph Recording Sheet*
 - *Comparison Sheet*

- Christine Browning and Dwayne Channell. “A Move in the Right Direction” Graphing Calculator Activities for Enriching Middle School Mathematics, 1997: 113–122.
- Johnson, Iris D. “Mission Possible! Can You Walk Your Talk?” *Mathematics Teaching in the Middle School* 6 (October 2000): 132–34.

Development/Procedures:

Lesson 1 Preassessment & Launch – Display the screen shot of $y = x$, graphed in the first quadrant only. Display this graph using the overhead projection calculator screen or the provided transparency. Note that the graph does not include any labels or scale. Ask the students to think of situations that could be described by the graph in a think–pair–share format.

Teacher Facilitation – As students share their ideas with the class, facilitate the discussion. Use this time to review concepts such as the x –axis, y –axis, dependent variable and independent variable. Once students have had an opportunity to share and discuss their ideas, emphasize an example using distance versus time. Introduce the graphing calculator. This will likely be the first time using the graphing calculator for many sixth graders. Teachers will need to address basic operations of the graphing calculator (on/off, screen contrast, formatting, window, and applications). Then introduce the CBR (Calculator–Based Ranger) using the resource sheet provided. Select a kinesthetic learner to move randomly in CBR range. Display the results to demonstrate what the CBR records.

Student Application – Have students brainstorm plans as to how they will use the CBR to create a graph that matches the graph of the equation $y = x$. As a whole class, have the students attempt to match the graph using the CBR. Facilitate discussion about what aspects of the previous attempt worked and what needs to be adjusted. Emphasize ideas such as positive, negative, and no correlation.

Embedded Assessment – Students will have the opportunity in the next lesson to work in small groups with the CBR to match graphs. This will allow time for the teacher to assess individual understanding.

Reteaching/Extension –

- For those who have not completely understood the lesson, tomorrow’s activity will allow time for review and reflection.
- For those who have understood the lesson, tomorrow’s activity will allow time for them to do examples on their own. Harder examples or student created examples can be incorporated into the lesson.

Lesson 2 Preassessment & Launch – Students should work in groups of 2 – 4. Each group will be given a worksheet, which has six screen shots of different graphs. The graphs do not include any labels or scale. Students will be

asked to plan their movement strategy for creating the graph using the CBR. This should be documented in the *My Strategy* column of the *Match that Graph!* worksheet.

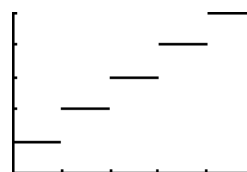
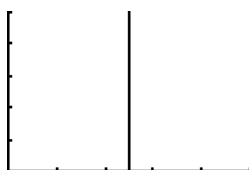
Teacher Facilitation – As students discuss their ideas with their group, walk around the classroom. Use this time to answer any questions students may have. Do not lead the students toward a “correct” answer. Allow students to grow into knowledge of the concept on their own.

Student Application – Have students attempt to create the graphs using the CBR. Students should document their thinking and adjust their plan for later graphs as they discover different strategies that help them achieve the graphs. Allow students to create graphs for their group members to match using the CBR.

Embedded Assessment – Students will be documenting their thinking on the worksheets provided. Have them share their solutions with the class. Allow groups to present ideas that are original or which extend the thinking of the class.

Reteaching/Extension –

- For those who have not completely understood the lesson, spend more time with their group assisting and answering questions about the activity.
- For those who finish the lesson early, have students attempt some additional challenge graphs or bring in the discussion of slope (the estimated speed of a walker).
- Ask analysis types of questions, such as “Can they create a vertical line?” and “Can they create a series of disjointed segments? Why or why not?”



Lesson 3

Preassessment and Launch– Students understand how to use graphs to compare two sets of data. Using the non-linear graph *Transparency Lesson 3* on the overhead, students will write a description of what the graph may represent. Allow students to volunteer their descriptions. Discuss as a whole group.

Teacher Facilitation– Distribute the worksheet *A Picture is Worth a Thousand Words*. Students may work individually or in small groups to create a graph for each situation.

Student Application—Students will create a graph for each situation. Students must label each axis in order to describe the situation being represented.

Embedded Assessment— Teacher will choose at least one of each student's graphs for evaluation.

Reteaching/Extension –

- For students that require reteaching, the teacher may use the CBR to provide additional kinesthetic examples.
- As an extension, students may create their own graphs on a graphing calculator and provide these graphs for class interpretation.

Summative Assessment:

To demonstrate their understanding of linear and nonlinear graphs, students will create a scenario described in a story format with a separate graphic interpretation. The story must describe a realistic situation and meet the criteria specified on the *Story Sheet*. All stories will be posted in clusters around the classroom. Assign students to a cluster and have them graph their individual interpretation of the stories using the *Graph Recording Sheet*. Once the graphs have been completed, the representations will be posted next to the matching story. The author of each story will review and compare his/her interpretation to those created by their peers on the *Comparison Sheet*.

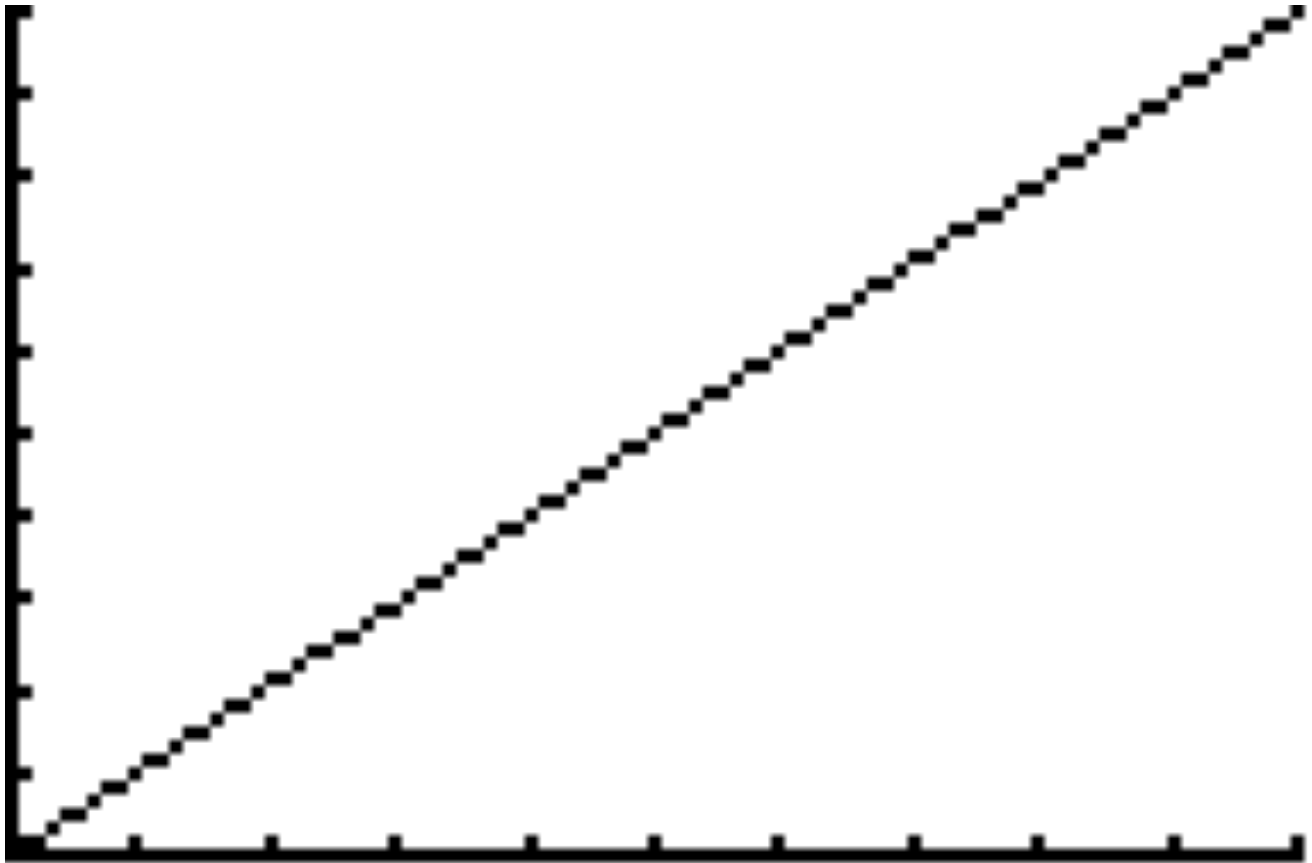
Authors:

Laura Partridge
Swanson Middle School
Arlington County, Virginia

Peter Corbat
Kingsview Middle School
Montgomery County, Maryland

Joanne Dennie
Argyle Middle School
Montgomery County, Maryland

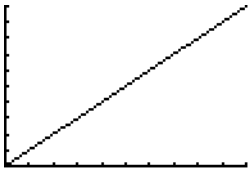
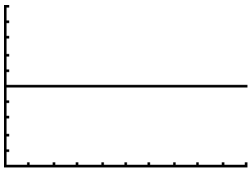
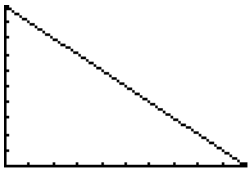
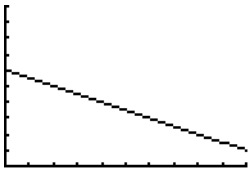
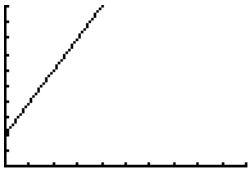

Transparency $y = x$



Match That Graph!

Name: _____

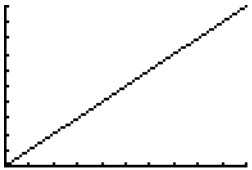

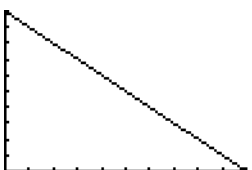
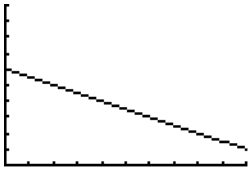
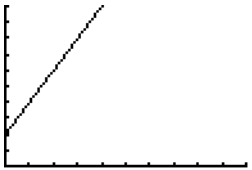

Date: _____

Graph Number	Graph to Match	My Strategy	Describe the Movement
1			
2			
3			
4			
5			
6			

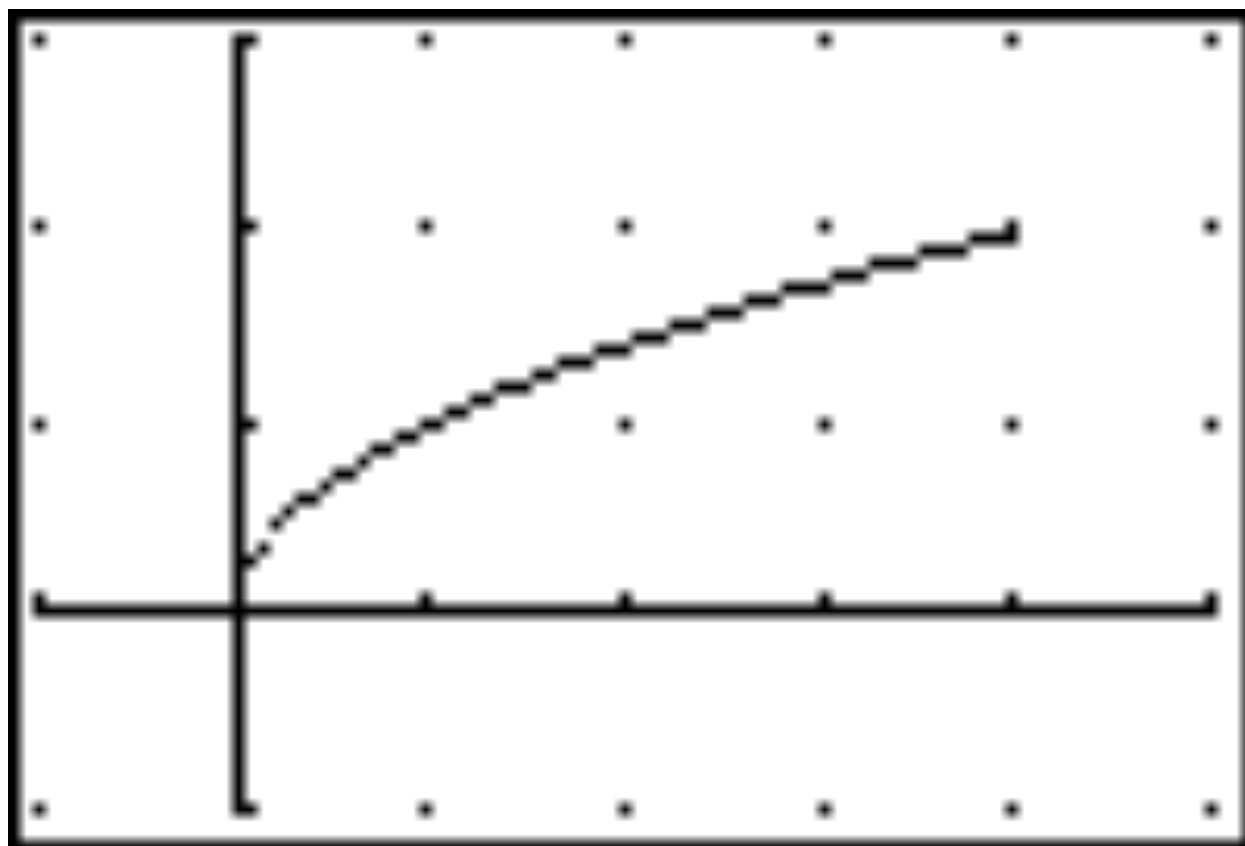
Match That Graph!

Name: ANSWER KEY

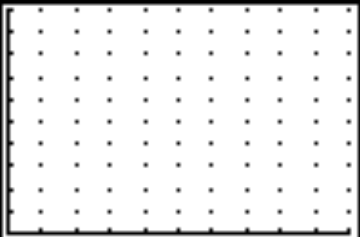
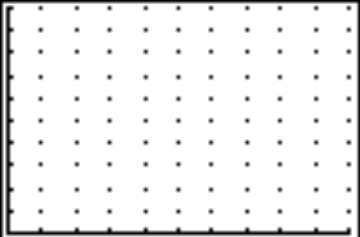
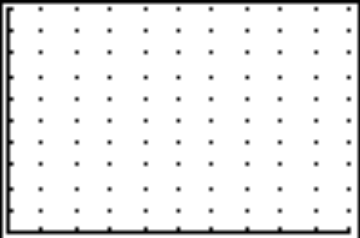
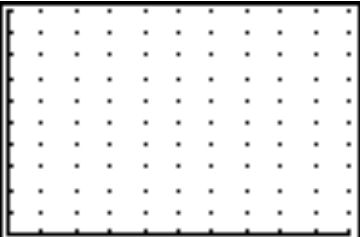
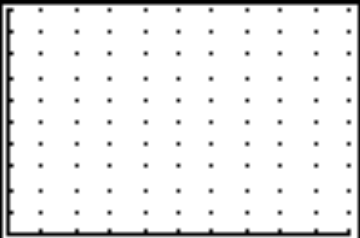
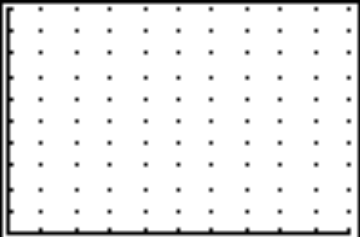
Date: _____


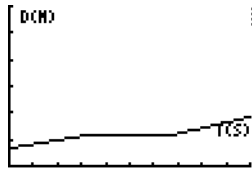
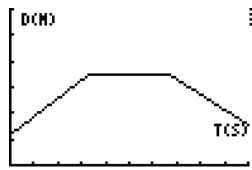
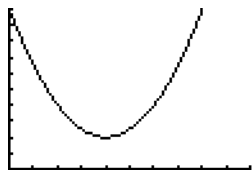
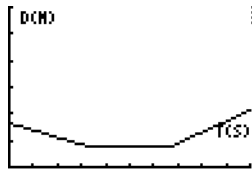
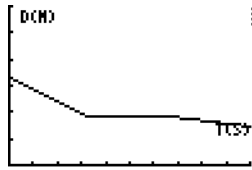
Graph Number	Graph to Match	My Strategy	Describe the Movement
1			Begin right in front of CBR and walk at a moderate but steady pace away from CBR.
2			Begin about 5 meters away from CBR and stand still until the CBR stops clicking.
3			Begin about 10 meters away from CBR and walk at a moderate but steady pace towards CBR.
4			Begin about 6 meters away from CBR and walk at a slow but steady pace towards CBR.
5			Begin 2 meters away from CBR and walk briskly at a steady pace away from CBR.
6			Begin right in front of CBR and walk briskly away from CBR, spin, and walk briskly back to where you began.

Transparency Lesson 3



Directions: On the axis provided, create a graph for each situation listed below.

Number	Story	My Representation
1	While Mikey was standing on the beach, he threw a rock as high as he could before the rock landed in the water.	
2	David sprinted for twenty seconds. He stopped for thirty seconds to catch his breath. He then continued sprinting for twenty more seconds.	
3	During a recent thunderstorm, the water level in the river increased at a steady rate and remained at a higher level for a period of time. The water then decreased nearly to the original level.	
4	The pilot decreased the plane's altitude to adjust for turbulence. Once the turbulence was over the pilot returned the aircraft to its previous cruising altitude.	
5	Diane threw her paper airplane. The airplane lowered at a constant speed, leveled off, and then rose at a constant speed until it was caught by Diane's friend Ellen.	
6	Attendance at the library's summer reading program was good at first, but it decreased steadily and then leveled off as families began their summer vacations.	

Number	Story	Possible Representation
1	While Mikey was standing on the beach, he threw a rock as high as he could before the rock landed in the water.	
2	David sprinted for twenty seconds. He stopped for thirty seconds to catch his breath. He then continued sprinting for twenty more seconds.	
3	During a recent thunderstorm, the water level in the river increased at a steady rate and remained at a higher level for a period of time. The water then decreased nearly to the original level.	
4	The pilot decreased the plane's altitude to adjust for turbulence. Once the turbulence was over the pilot returned the aircraft to its previous cruising altitude.	
5	Diane threw her paper airplane. The airplane lowered at a constant speed, leveled off, and then rose at a constant speed until it was caught by Diane's friend Ellen.	
6	Attendance at the library's summer reading program was good at first, but it decreased steadily and then leveled off as families began their summer vacations.	

Directions for Texas Instruments CBR (Calculator-Based Ranger™)

1	Connect the CBR to the graphing calculator using the calculator to CBR cable.	
2	Turn on the calculator by pressing on.	
3	Press APPS	
4	Select CBL/CBR and then press enter.	<pre> APPLICATIONS 1:Finance... 2:ALG1CH5 3:ALG1PRT1 4:AreaForm 5:CBL/CBR 6:CSheetDe 7:CSheetEs </pre>
5	Follow directions on screen by pressing any key.	<pre> ↓ TEXAS INSTRUMENTS CBL/CBR™ version 1.00 PRESS ANY KEY </pre>
6	Select RANGER and then press enter.	<pre> CBL/CBR APP: 1:GAUGE 2:DATA LOGGER 3:RANGER 4:QUIT </pre>
7	Follow directions on screen by pressing enter.	<pre> TEXASINSTRUMENTS RANGER (V1.00) PRESS[ENTER] </pre>
8	Select SETUP/SAMPLE and then press enter.	<pre> MAIN MENU 1:SETUP/SAMPLE 2:SET DEFAULTS 3:APPLICATIONS 4:PLOT MENU 5:TOOLS 6:QUIT </pre>
9	Set Real Time	<p>No: Graph will not display as you are moving; however length of time can be adjusted.</p> <p>Yes: Graph will display as you are moving; however length of time cannot be adjusted.</p>
10	Press ▲ to select START NOW and then press enter.	
11	Follow directions on screen.	

*For complete instructions, consult your CBR/CBL manual.

Directions: Write a story that meets the criteria below. Create a graphical representation of your story.

Criteria:

Your story must include:

- a realistic situation that can be graphed
- at least one paragraph

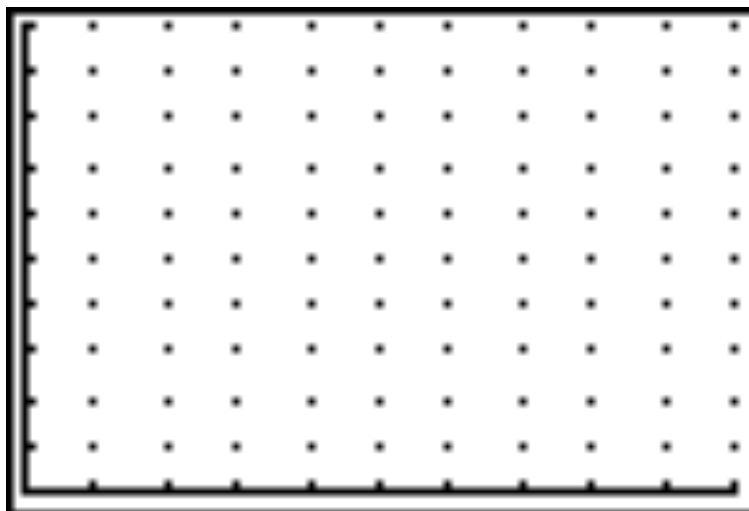
Your graph must include:

- two to three linear sections
- one to two nonlinear sections

Cluster #__ Story #__

Name: _____

Cluster #__ Story #__



Cluster #__ Story #__



Name: _____

Cluster #__ Story #__



1. Identify similarities and differences between your graphical representation of your story and those of your classmates.

Similarities	Differences

2. Are the differences valid representations of your story? Justify your reasoning.

3. Revise your story to include more descriptive language to better represent your interpretation.
